

I CLAIM:

Sub A1
1. A method of detecting fractures in a fractured zone in an Earth formation, a plurality of acoustic waves propagating through the fractured zone and reflecting off a horizon in the formation and, responsive thereto, a plurality of seismic traces representative of said acoustic waves propagating through said fractured zone being received and recorded, a first portion of said seismic traces corresponding to a first window located above said fractured zone in said formation, and a second portion of said seismic traces corresponding to a second window located below said fractured zone in said formation, said method comprising the steps of:

generating a first frequency spectrum associated with said first portion of said seismic traces corresponding to said first window;

generating a second frequency spectrum associated with said second portion of said seismic traces corresponding to said second window;

superimposing said first frequency spectrum onto said second frequency spectrum thereby generating a superimposed frequency spectrum and defining from the superimposed frequency spectrum a low frequency (low) and a high frequency (high);

when said low frequency and said high frequency is defined,
further defining from the superimposed frequency spectrum a
plurality of amplitude values, said plurality of amplitude
values including: Fa(high), Fa(low), Fb(high), and Fb(low);

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from said plurality of amplitude values, defining a t*
attribute; and

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plotting the t* attribute value on a map and assigning a
unique color to said t* attribute value.

2. The method of claim 1, wherein the step of defining a
t* attribute value from said plurality of amplitude values
comprises the step of:

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defining a value 'F high' from a first formula, as follows:

$$F \text{ high} = Fa(\text{high}) / Fb(\text{high}).$$

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3. The method of claim 2, wherein the step of defining a
t* attribute value from said plurality of amplitude values
further comprises the step of:

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defining a value 'F low' from a second formula, as follows:

$$F \text{ low} = Fa(\text{low}) / Fb(\text{low}).$$

4. The method of claim 3, wherein the step of defining a t* attribute value from said plurality of amplitude values further comprises the step of:

5 defining said t* attribute value from a third formula, as follows:

$$t^* = [\ln (F \text{ high}) - \ln (F \text{ low})] / (\text{High} - \text{Low}).$$

10 5. A program storage device readable by a machine, tangibly embodying a program of instructions executable by the machine to perform method steps for detecting fractures in a fractured zone in an Earth formation, a plurality of
15 acoustic waves propagating through the fractured zone and reflecting off a horizon in the formation and, responsive thereto, a plurality of seismic traces representative of said acoustic waves propagating through said fractured zone being received and recorded, a first portion of said seismic
20 traces corresponding to a first window located above said fractured zone in said formation, and a second portion of said seismic traces corresponding to a second window located below said fractured zone in said formation, said method steps comprising:

25 generating a first frequency spectrum associated with said first portion of said seismic traces corresponding to said first window;

generating a second frequency spectrum associated with said second portion of said seismic traces corresponding to said second window;

5 superimposing said first frequency spectrum onto said second frequency spectrum thereby generating a superimposed frequency spectrum and defining from the superimposed frequency spectrum a low frequency (low) and a high frequency (high);

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when said low frequency and said high frequency is defined, further defining from the superimposed frequency spectrum a plurality of amplitude values, said plurality of amplitude values including: Fa(high), Fa(low), Fb(high), and Fb(low);

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from said plurality of amplitude values, defining a t* attribute; and

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plotting the t* attribute value on a map and assigning a unique color to said t* attribute value.

6. The program storage device of claim 5, wherein the step of defining a t* attribute value from said plurality of amplitude values comprises the step of:

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defining a value 'F high' from a first formula, as follows:

$$F \text{ high} = Fa(\text{high}) / Fb(\text{high}).$$

7. The program storage device of claim 6, wherein the step of defining a t* attribute value from said plurality of amplitude values further comprises the step of:

5 defining a value 'F low' from a second formula, as follows:

$$F \text{ low} = Fa(\text{low})/Fb(\text{low}).$$

8. The program storage device of claim 7, wherein the step
10 of defining a t* attribute value from said plurality of amplitude values further comprises the step of:

defining said t* attribute value from a third formula, as follows:

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$$t^* = [\ln (F \text{ high}) - \ln (F \text{ low})]/(\text{High} - \text{Low}).$$

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9. An apparatus adapted for detecting fractures in a fractured zone in an Earth formation, a plurality of acoustic waves propagating through the fractured zone and reflecting off a horizon in the formation and, responsive thereto, a plurality of seismic traces representative of said acoustic waves propagating through said fractured zone being received and recorded, a first portion of said seismic
25 traces corresponding to a first window located above said fractured zone in said formation, and a second portion of said seismic traces corresponding to a second window located below said fractured zone in said formation, said apparatus comprising:

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first means for generating a first frequency spectrum associated with said first portion of said seismic traces corresponding to said first window;

5 second means for generating a second frequency spectrum associated with said second portion of said seismic traces corresponding to said second window;

10 third means for superimposing said first frequency spectrum onto said second frequency spectrum thereby generating a superimposed frequency spectrum and defining from the superimposed frequency spectrum a low frequency (low) and a high frequency (high);

15 fourth means for further defining, from the superimposed frequency spectrum, a plurality of amplitude values when said low frequency and said high frequency is defined, said plurality of amplitude values including: $F_a(\text{high})$, $F_a(\text{low})$, $F_b(\text{high})$, and $F_b(\text{low})$;

20 fifth means for defining a t^* attribute from said plurality of amplitude values; and

25 sixth means for plotting the t^* attribute value on a map and assigning a unique color to said t^* attribute value.

10. The apparatus of claim 9, wherein said fifth means for defining a t^* attribute value from said plurality of amplitude values comprises:

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means for defining a value 'F high' from a first formula, as follows:

$$F \text{ high} = Fa(\text{high})/Fb(\text{high}).$$

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11. The apparatus of claim 10, wherein said fifth means for defining a t* attribute value from said plurality of amplitude values further comprises:

10 means for defining a value 'F low' from a second formula, as follows:

$$F \text{ low} = Fa(\text{low})/Fb(\text{low}).$$

15 12. The apparatus of claim 11, wherein said fifth means for defining a t* attribute value from said plurality of amplitude values further comprises:

20 means for defining said t* attribute value from a third formula, as follows:

$$t^* = [\ln (F \text{ high}) - \ln (F \text{ low})]/(\text{High} - \text{Low}).$$

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